

8A No. 1 Hole

Goal

Demonstrate the feasibility of conducting methane pre-drainage activities from the surface using articulated drilling. Demonstrate a method to reliably de-water the horizontal well bore. Drill under balanced.

Problems

Wilson concurrence of well plan only at last minute
No clear project oversight from WellTech (prime vendor)
S.W. Jack rig was not set-up as required - make-up tongs/ dies; pull down capability
Wilson back-up directional hand inexperienced
Difficulty detecting when bit started to leave coal formation
Morning reports not available
Failed to reach target depth - torque & drag exceeded expectations
Flow Line not adequately secured
Rig floor progress plots were not kept up
Difficulty re-entering previously drilled sidetracks to clean holes
Pits leaked
Awkward vendor organizational structure - WellTech, Wilson, S.W. Jack

What went well

Perfect radius - intercepted +/- 2 ft of cavity
Pump jack de-watering pump system

Lessons Learned

Involve field crews in well planning process
Use contract field engineer to oversee drilling operations
Have flow lines buried
Use correct drilling rig for the job
Clean-up drilling fluid in order to detect changes in formation
Take decisive action when bit leaves coal; pull back and sidetrack
Use MWD to get into previously drilled holes to flush

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Articulated Drilling - Project Review

DLS-1

Problems

**Organizational
Planning
Communication
Supervision**

**Morning Reports
Progress Plots**

Equipment - Pumps, Spares

Location - Pits

Start-up - Hole not deep enough, parts & supplies

Failed to Reach Target Depth - Torque & drag

Difficulty Detecting Floor & Roof

Flow line

Blowing holes clean - markers

**Lessons Learned
Steering**



WILSON DOWNHOLE SERVICES 220 EAST 16TH STREET • TRAVERSE CITY, MI 48684 • 616-947-2977 • FAX: 616-947-2978
Division of Houston Engineers, Inc.

May 30, 1997

Mr. Joe Zupanick
US Steel Mining Co.
Pinnacle Creek Rd.
Pineville, WV 24874

Dear Joe:

The following information is a breakdown of the daily activities, in hours, for all operations performed in that 24 hour period. This information is derived from the directional driller's daily reports and log books.

DAY #1 - TRAVEL

5/1/97 Move rig in and rig up. Wilson Downhole Services drillers
travel to West Virginia

DAY #2 - OPERATIONAL

5/2/97 Load drill pipe and drill collars on trailer and drive to location.
Depth 634' Trip in with bit #1, 4 $\frac{3}{4}$ " drill collar, and 3 $\frac{1}{2}$ " drill pipe3 hrs.
Drill 6 $\frac{1}{4}$ " hole from 634' - 710' T.V.D.1 hrs.
Trip out and load 4 $\frac{3}{4}$ " drill collars and 3 $\frac{1}{2}$ " drill pipe on trailer6 hrs.
Hook up mud pumps and wait on directional tools.....1.5 hrs.
Unload directional tools & MWD equipment2.5 hrs.
Pick up directional bottom hole assembly & MWD3 hrs.
Test motor and trip in hole2 hrs.
Work on mud pump and reline mud pits5 hrs.

DAY #3 - OPERATIONAL

5/3/97 Drill radius with 4° motor in 4 $\frac{3}{4}$ " hole6.5 hrs.
Depth 710' Work on mud pump, 5 swabs leaking, liner not staying cool17.5 hr

DAY #4 - OPERATIONAL

5/4/97 Work on mud pumps3.5 hrs.
Depth 805' Drill radius in 4 $\frac{3}{4}$ " hole.....7.5 hrs.
Trip out of hole for drill out motor and new bit.....7 hrs.
Test motor and MWD, trip in hole.....3 hrs.
Drilling @ 862'3 hrs.

August 27, 1997

To: Lawrence Stacy

Fr: Joe Zupanick

Re: Plan to mine into Articulated Holes on 8A (DW-1)

Current gas production is 160 mcf/d (110 cfm) of methane.

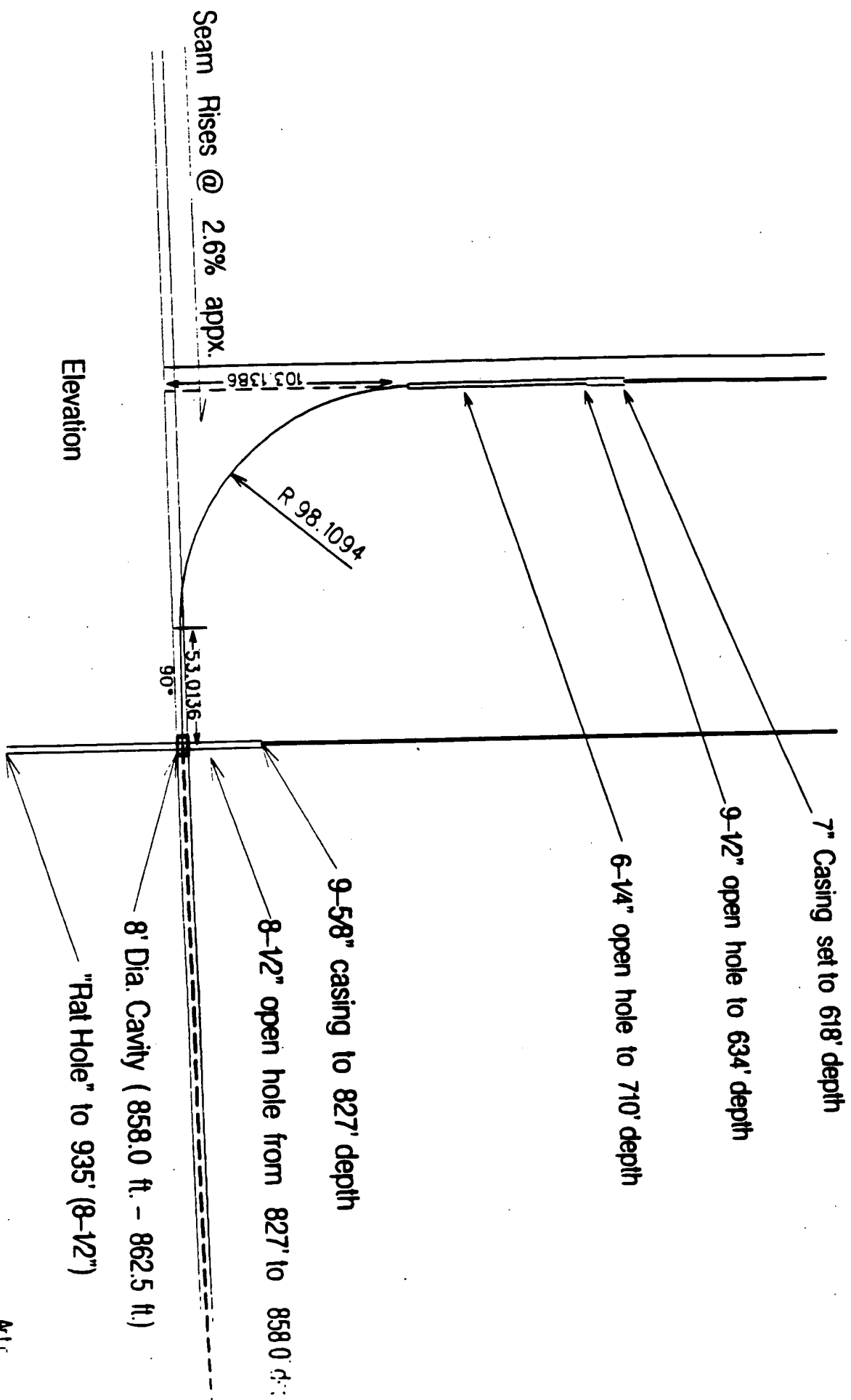
Compressor is pulling a vacuum on the hole. The vacuum control valve is set to control the compressor vacuum at the surface to -3.0 psig. This should provide slight pull of mine air into the borehole when mine connection is made.

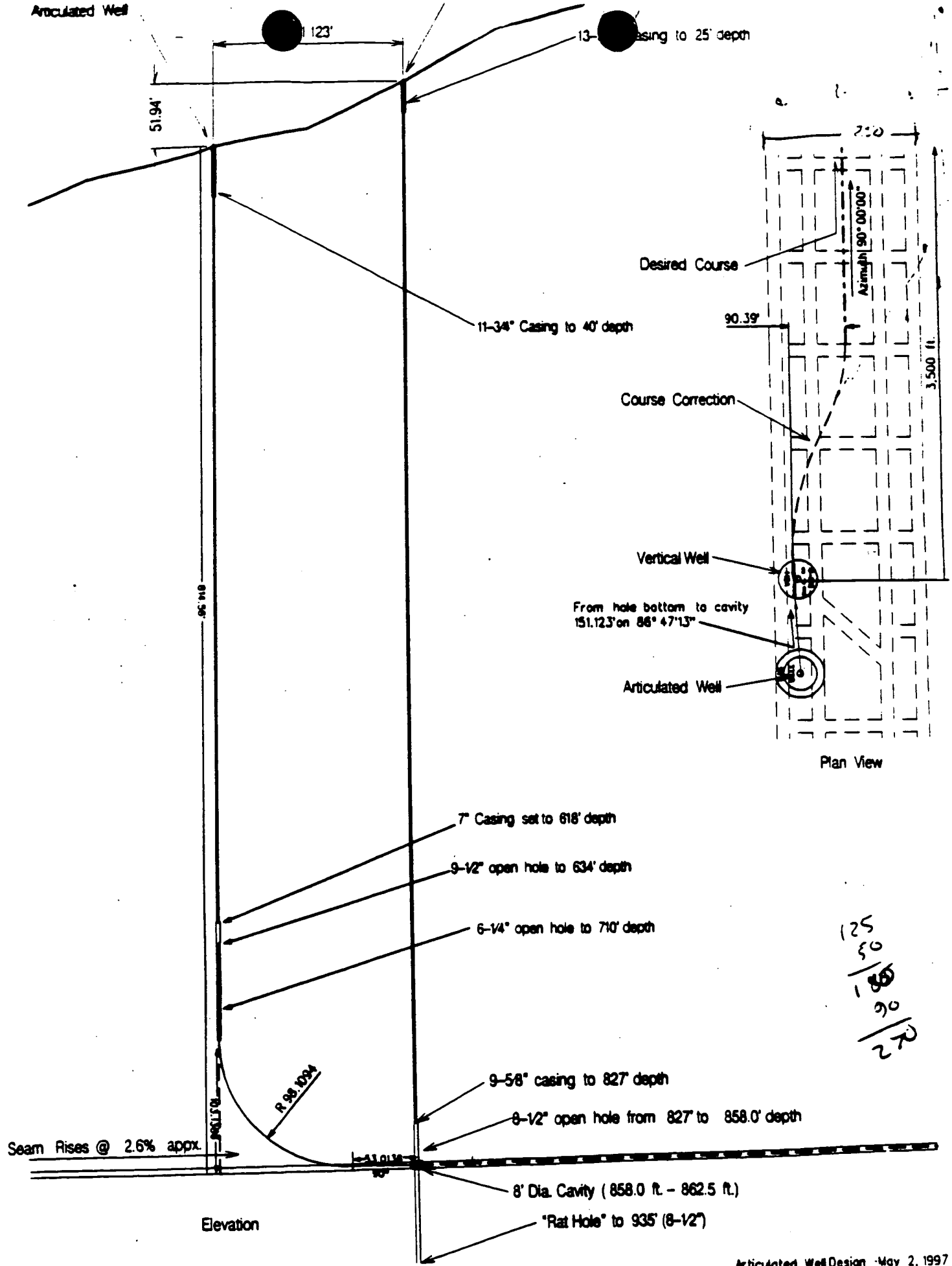
An oxygen sensor is set to kill the compressor engine at 6% O₂ (30% air - 70% CH₄). If too much air is pulled into borehole, the compressor will go off, thus allowing the entire gas production to flow into mine.

Because of risk of compressor shut down, CM unit should notify the computer room once hole is penetrated so that one of the surface people can go to the compressor location and adjust vacuum if necessary. The vacuum should be set to that necessary to pull slight vacuum into borehole at mine level. There is a 10 minute delay for air that enters the borehole to reach the compressor.

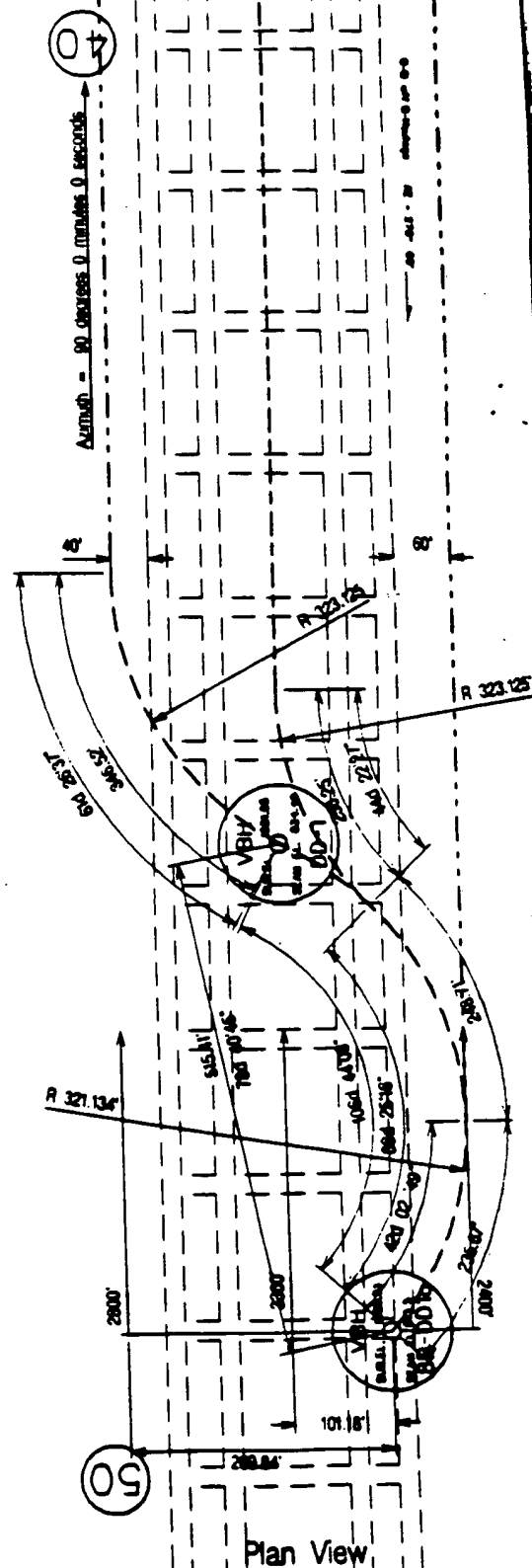
Computer room may see "high vacuum" alarm at this site. This vacuum alarm is tied to the oxygen monitor, and is set to alarm at 0.9 % O₂.

If unacceptable quantities of gas flow from the hole into the mine, use a Tam LD-275 packer (orange and yellow) to plug the hole and seal off gas flow. This packer will inflate to seal the 4.75" diameter hole.

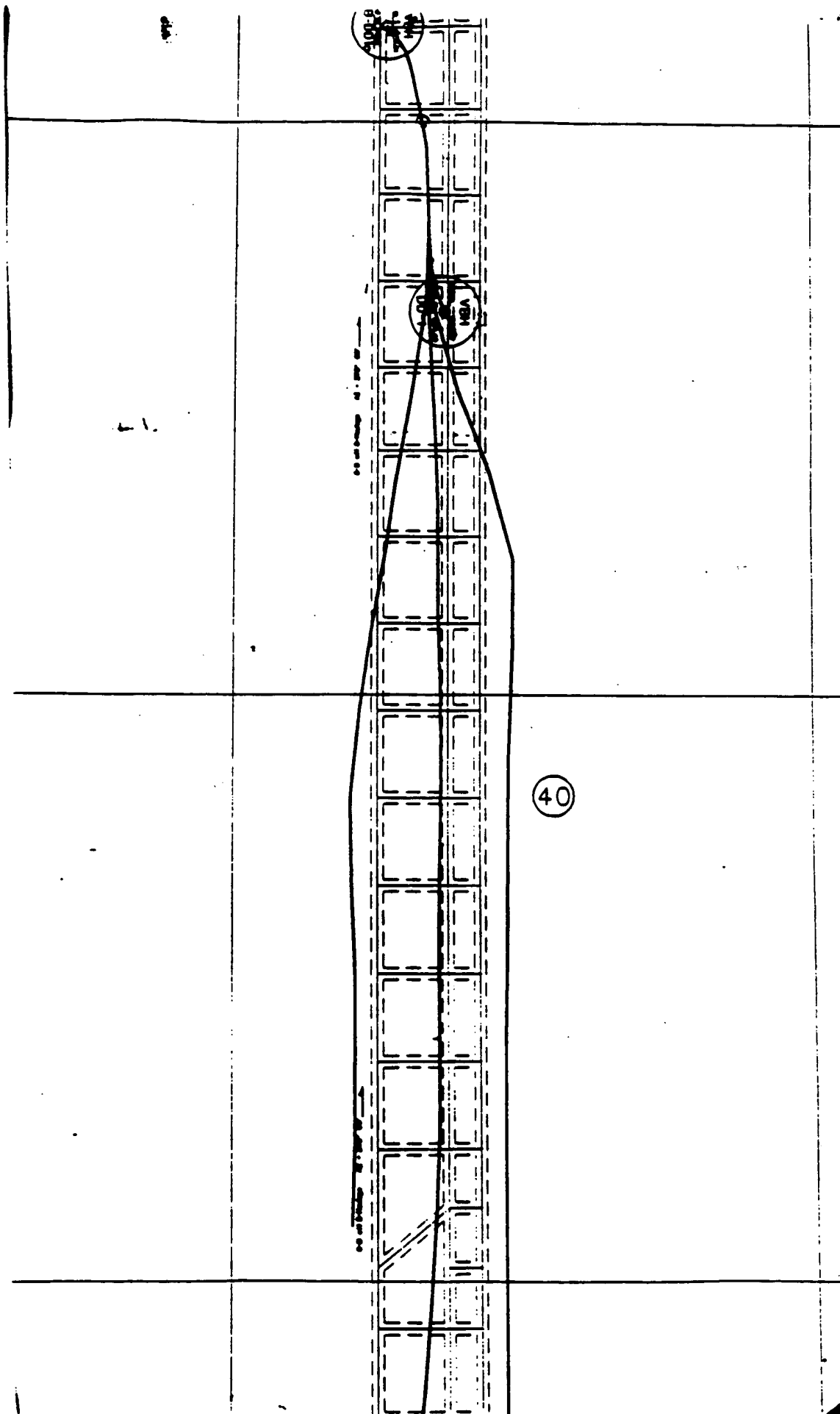




125
30
180
90
270



D



40

Dw-2

8B No. 1 Hole

Goal

Increase time spent drilling coal. Attempt to use analysis of return cuttings (mud logging) to make predictive assessments of when the bit is starting to leave the coal formation. Use rig with adequate weight on bit capabilities.

Problems

- Last minute changes to well plan.
- No clear project oversight from WellTech (prime vendor)
- WellTech rig was not set-up as required - make-up tongs.
- Wilson back-up directional hand inexperienced.
- Difficulty detecting when bit started to leave coal formation; mud logging inconclusive
- Difficulty re-entering previously drilled sidetracks; cavity
- Excessive tri-cone bit usage; required fishing job for bit cones and caps
- Casing annulus too large; insufficient fluid velocity to carry solids
- WellTech crews rotated throughout job
- Problems with air; not enough pressure, no spare
- Record keeping problems - missing sidetrack data
- Bubble tube water level measurement becomes blocked
- Low gas production due to damaged coal permeability

What went well

- PDC bit held up well
- Contract engineer supervision
- Plotting hole path as drilling progressed
- "Geolo-graph" rate of penetration (ROP) recorder kept record of rig performance
- Portable toilets on location

Lessons Learned

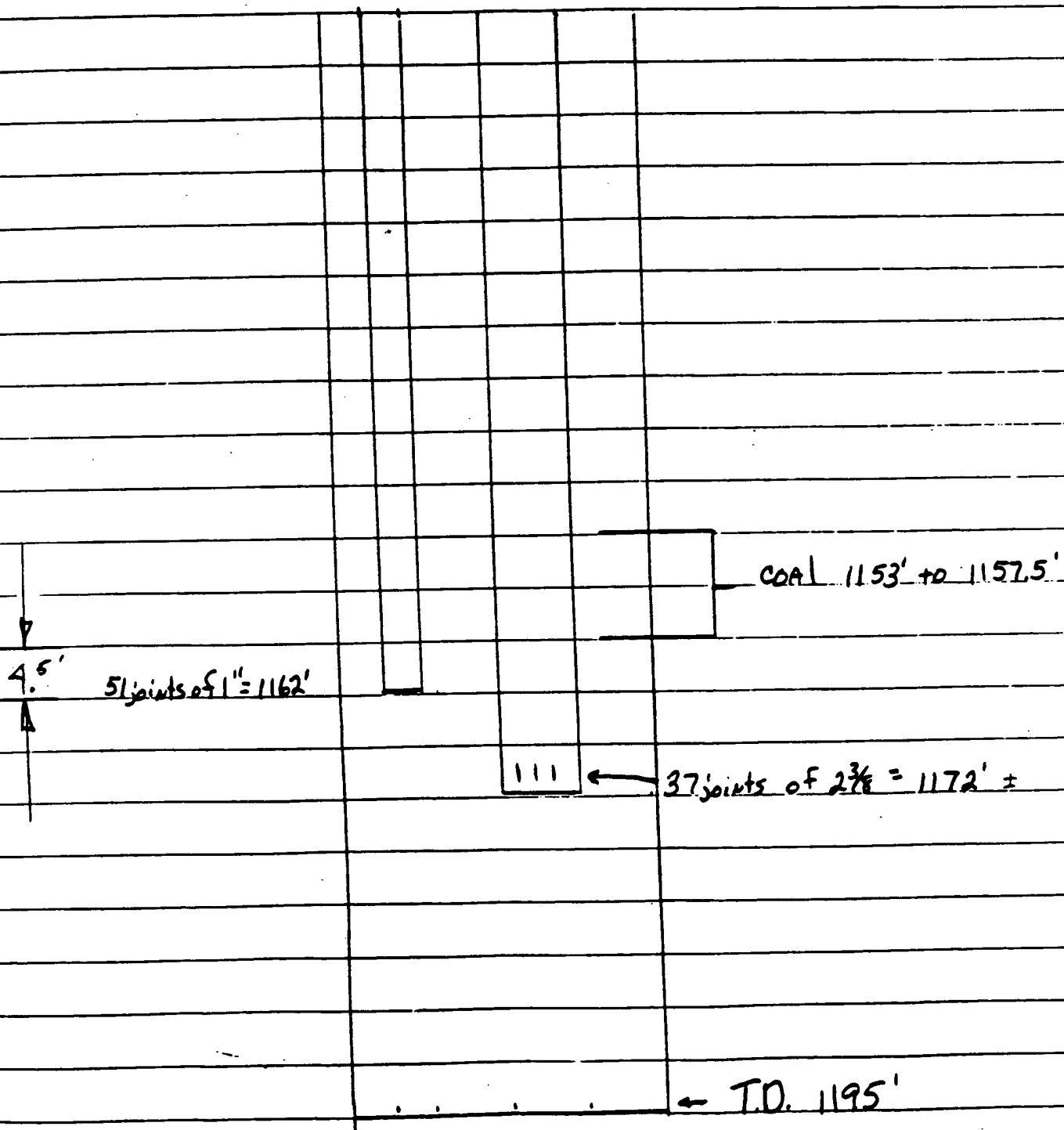
- All hole legs must pass through cavity; keep cavity hole close to articulated hole
- Best indicator of bit location is ROP
- Attempt to keep bit at top of coal seam; constantly slide "up".
- Have planed plot of hole on large scale map on which to mark progress
- Drill in inert environment; no oxygen, use bactericide in water
- Do not use flocculent chemicals to clean pit fluid

11/20/97

OW 2 - 8BDD1 vertical small barrel pump

coal 1153' to 1157.5' T.O. 1195'

37 joints $2\frac{3}{8} = 1172'$ 51 joints $1" = 1162'$ 46 $\frac{3}{4}"$ rods





PETROLEUM ENVIRONMENTAL TECHNOLOGIES INC.

P.O. Box 87 • 5581 Rapid City Road • Rapid City, MI 49676-0087
(616) 258-0400 • Fax: (616) 258-0401

July 6, 1997

To: Mr. Joe Zupanick \ US Steel

From: Mr. Larry Thompson \ PET, Inc.

RE: General

I have been informed from AMT, that they are ready to start up the closed loop system, on Tuesday July 8th, 1997. I personally will return for this operation.

I spoke with Alex, yesterday evening. He informed me that the drilling was completed. We discussed the fluid in general to some length. We have worked on some other types of chemistry which has worked much better (in the Lab). As well I have discussed the fluid with Rich, about a week ago. It would appear to me that above ground could be drilled on a closed system, under balance using air, with a gas buster, in line before the tanks. A closed system has many quality features that an in ground system does not have.

I am bringing along with me 2 bags of the superabsorbent polymer (100W) that you requested. I will bring a particle size that I think will best serve your needs. In addition I will bring along 5 sample sizes for your review as well. Some additional interest has been expressed in these products, by Mr. woody Wyatt, & Mr. Roy O'Niel. We use virtually tons of these products annually for many applications. These products are very stable, easy to use, and perform very well in many different applications, with out increasing the waste mass.

I will see you the week of July 7th, 1997.

Best Regards,

FINAL REPORT

Well: Articulated Well 8B-DD1a
 State: West Virginia
 County: Wyoming
 Project: Coal Degassification
 Elevation: GL: 1985.51 KB: 1994.5
 Formation(s): Middle Penn. Allegheny / Poca Seam No.3
 Spud Date: kick / 6-10-97
 Final TD: Leg #1=3713' MD Leg #2=3604' MD Leg #3=3182' MD
 Total days: 32 / horiz.
 Cost of well(approx): \$ 620,000.00

- Date: Activity:
- 6/9 Rigging up WellTech rig #290
- 6/10 MIRUWilson directional equipment, start in hole bit through rig floor @ 8PM 6-10-97, TTH tag cement @ 935'. Down 4 hrs. to replace leaking swivel packing. Drill cement to 1008' begin kick. Drilled ahead directional using mud motor.
- 6/11 Drilled ahead building angle. @ 1032' TOH bit worn badly on shanks 3 steel caps gone / in hole. Call for magnet. TTH circ. and TOH; returned 1 steel cap, washers, ball bearings and magnet full of fillings. TTH w/ magnet circ. and TOH returned 2 steel caps, ball bearings and magnet full of fillings. Lay down magnet, pick up BHA and bit #2 (Smith MF37P w/ 3-16 jets) and TTH. Resumed drilling / using mud motor, building angle, surveys @ approx every 5'. Topped coal seam marker bed @ 1125' MD gr. datum (projected top of No. 3 POCA SEAM @ 1169' TVD at 38' from Vert hole. Survey @ 7AM @ 1143' MD = N 57.9243 E, angle = 52.52 deg.
- 6/12 Drilled ahead building angle through sandstone, shale and siltstone to 1195' KB. TOH to change BHA. Stuck in hole 2 hrs. work pipe and circulate pipe free past tight spot @ 1100' KB. TOH w/ BHA & bit #2; moderate-heavy wear on shanks. Change out BHA and pick up bit #3 (Smith MF156P w/ 3-16 jets) TTH, tag bottom at 1105' circ down to 1110'. could not get to bottom, TOH, shanks worn on bit #3. Pick up bit #4 (Smith MF156P w/ 3-16 jets) TTH, tag bottom @ 1110' washed down to 1180' could not get to bottom concern about possibly drilling a new hole. TOH, some wear on bit #4 (reusable). Lay down mud motor, pick up bit #3 (Smith MF156P w/ 3-16 jets return from last hole) TTH without mud motor to circulate down and clean up hole.
- 6/13 TTH w/ bit #3, tag bit at 1130' MD, hook up swivel, circulate and rotate to bottom. Clean up hole, TOH, MIS 5/8" casing truck, pick up and run 23 jts 8 5/8" : 236 casing w/ packer above bottom joint set down on bottom at 938.5' gr. packer at 893' gr (+-4' above bottom of 11 3/4" casing. Welder fabricated casing support and set onto 11 3/4" casing. Nipple up on 1 5/8" casing nipple. Pick up BHA and bit #4 (return Smith MF15GP (3-16/32") TTH. Drilled ahead building angle through sandstone, shale and siltstone.
- 6/14 Drilled ahead building angle through shale and sandstone. Drilled through POCA Seam #3 @ 78 deg @ 1312' MD, 1161' TVD. build angle to 93 deg+, drilled back into base of seam at 1430' MD. Drilled rotate & drill ahead and out of top at 1533' MD, retreat tool, drill back down into top of seam at 1564' MD, then out again @ 1595' (prob. out through bottom). Reorient tool up, drilled ahead 6 feet, then drilled very fast and lost circulation at 1601' MD (new vertical hole) no returns. Attempt to aerate fluid with air compressor at vert. hole. Horiz hole began to unload, then stopped; Air booster could not unload hole(s). Begin TOH.
- 6/15 TOH with BHA & Bit #4, stopped half way out and unloaded hole by pumping air. TOH check bit and TTH, attempt to drill, insufficient air volume to aerate fluid. Drilled ahead with fluid. Drilled coal 1604' MD to 1620' MD, out of seam #3 (below) @ 1620'-23', in seam #3 @ 1634'-40' (below), out of seam #3 @ 1640'-56' MD, last two feet drilled at 15-20 min/ft. TOH check bit, 3 grease caps missing from bit. Pick up 3.5" magnet and TTH TOH w/ magnet, returned 2 caps. Lay down magnet, pick up BHA & bit #6 (Smith MF15GP; 3-16/32") and TTH to start right side track leg with fluid while waiting for additional air compressor.

Articulated Well 8B-DD1a Report Page 1

- 6/16 TTH and begin firing side track (South/right leg) w/ bit #6 @ 1249' MD. Drilled ahead (sliding) tag coal seam #3 @ 1309' MD and slid back into old hole. Picked up and worked pipe to try to find side track and kick out of original hole. Established a #3 leg to 1334' MD. TOH lay down motor. Two Ingersoll Rand 900 air compressors moved in from Sommerret. Penn. hook one to well, one at vertical well. TTH to 600' start air compressor at the well and air compressor at vertical well and unload fluid from hole. Move air compressor from SB-DD-1a to vert. well. TOH pick up bit #7 Smith MP15GP (3-16/32") and motor and TOH to drill ahead in original hole (#2 on well diagram).
- 6/17 TTH with bit #7 and BHA to extend original hole. Tag #3 leg @ 1374' MD, could not get into original hole, side track into coal seam #3 @ 1471' MD drilled ahead in coal seam to 1660' MD, went out of seam 1660' to 1687', then back into coal. Drilled to 1999' MD mostly in the coal w/ several short intervals just out of seam. Drilled out of coal at 1999 to 1975' MD. Pulled back to redrill ahead from 1935' in the coal seam. McCoy Construction surveyed road.
- 6/18 Redrilled 1935' MD in coal seam #3. Drilled ahead in coal from 1935 to 2128' MD. Drilling slowed drilled 2128' - 2143' MD, just below, not in coal. TOH check bit and BHA. Bit #7 showed wear on shanks, one ramp ring missing. Pick up bit #8; Smith MP15GP w/ diamond enhanced carbide on shanks of bit & 3-16/32" jets, TTH. Drilled 2143' - 2235' MD attempting to rise up into base of coal. McCoy Construction put more gravel on road.
- 6/19 Drilled 2143' - 2315' MD attempting to rise up into base of coal. TOH to check MWD, bit #8 and to add drill collars. Layed down bit #8 (moderate wear / runnable), ck out MWD tools, picked up bit #9, and TTH work down hole through tight spot at 2000', add five (5) 6" drill collars to drill string. Drilled ahead up into coal seam #3 @ 2412' MD - 1123' TVD. (estimated #3 seam grade - 6% from 2128' - 2112') Slid forward to attempt to reduce 96.6 deg. inclination.
- 6/20 Drilled in coal seam #3, attempt to reduce 96.6 deg. inclination. Scraped top and out of seam at 2498' MD. Back into coal seam at 2533' MD. MWD: problem getting survey. TOH impact tool and bit #9 (High wear). Reran bit #9, MWD tools, BHA, tubing. 5 - 6" drill collars, add 4.5' drill pipe. Drilled along at top of coal from 2564' to 2632' MD. Appeared to drill out of top @ 2632' MD. Drilled to 2687' MD steering bit down attempt to get back down & into seam #3.
- 6/21 Drilled to 2711' MD steering bit down attempt to get back down & into seam #3. Pulled back to 2420' MD side track sliding to establish new hole, drilled ahead, sliding and rotating in coal seam #3 to 2836' MD. Third Ingersoll Rand 900 air compressors moved in from Sommerret, Penn.
- 6/22 Drilled in coal to 2938' MD out bottom of seam @ 2938' - 1108' TVD. Slid back up into base of seam @ 3005' MD - 1104' TVD. Drilled ahead, sliding and rotating in coal seam #3 to 3079' MD, collars at base of 8 5/8" casing, top of 4 3/4" hole. TOH to add tubing below collars and to check bit/tools. Bit #9 through floor 8:15 PM, moderate wear on bit & loose cone. Lay down bit #9. Pick up bit #10, (Smith MP15GP (3-15/32") IN LM3532, TTH, work / swivel through tight spots.
- 6/23 TTH w/ bit #10, BHA, collars and drill pipe. On bottom 11:30 AM. Drilled ahead in coal / slide and rotate through Penn coal seam #3 until collars close to 4 3/4" hole, to 3604' MD: total depth of #2 leg. Circulate and survey, lay back swivel and start TOH.
- 6/24 TOH w/ drill string to 1430' MD lay down drill pipe stand back collars. On bottom 2:00 PM. Begin #3 leg w/ 1498' M7. Drilled in base of coal 1485' MD drilled out of top @ 1599 (drew rock at 1588'7) Back into seam at 1630' - 1636' MD. Drilling slowed and motor problem begin TOH at 4 AM. Bit through the floor @ 6:15 AM Lay down and motor, MWD tool & bit #10 (good condition / re-runable). Pick up bit #11- (Smith MP15GP enhanced w/ diamond-carbide on shanks/skirts and carbide inserts to the side of grease caps). and motor and MWD tool TTH.
- 6/25 TTH with bit #11, BHA & tubing, to continue leg #3. On bottom 11 AM, drilled ahead back through the top of coal 1726' MD (1156' TVD). Drilled out of base @ 1780' MD back in 1833' MD (1153.5' TVD). Drilled ahead in seam #3 from 1833' - 2310' MD.

- Drilled ahead in seam #3 (out top @ 2345') to 2372' MD. TOH lay 11 joints tubing, pick up and run (1119' TVD). Drilled along top collars and start drilling w/ drill pipe. Back into the top of coal 2429' (1119' TVD). Drilled along top then out and ran just above top. 8 5/8" casing head weld broke & casing began to slide down, shut down 5 hrs to get welder to repair it. Drilled ahead attempting to get back into top of Poca seam #3 - 2590' MD.
- 6/27 Drilled ahead attempting to get back down into top of Poca seam #3. TOH for bit @ 2495' MD. Bit #11 worn out (lower bearing, side wear, 3 missing gauge caps). Lay down bit #11, pick up bit #12, TTH w/ BHA, tubing, 12 drill collars & drill pipe to 2430' MD and begin side track in coal, sliding down & left.
- 6/28 Established side track in coal seam #3 @ 2435' MD. Drilled ahead sliding & rotating in coal. Scraps base of seam from 2545 - 2583' KB/MD, then back in. Drilled ahead in Poca seam #3 to 2988'. Last 20 feet of seam from 2545 - 2583' KB/MD, then back in. Drilled ahead in Poca seam #3 to 2988'. Last 20 feet drilled slower (collar friction near bottom of 8 5/8" casing?). TOH to move drill collars up in the drill string and then resume drilling.
- 6/29 TTH add tubing below collars, drill ahead attempting to get back up into coal seam #3. Up into seam @ 3112' MD (base @ 1093' TVD). Drilled ahead sliding & rotating in coal, then out of the top drilled to 3182' MD. Pulled back to 3110' MD attempt to side track unsuccessfully. TOH for bit. To begin leg #1 side track. Scraps base of seam from 2545 - 2583' KB/MD, then back in. Drilled ahead in Poca seam #3 to 2988'. Last 20 feet drilled slower (collar friction near bottom of 8 5/8" casing?). TOH to move drill collars up in the string and then resume drilling.
- 6/30 TOH w/ bit #12 (bad bearing), pick up bit #13: Smith MF15GP, SN LM3721, BHA, and TTH. Start side track kicking out Leg #1 at 1515' MD/KB. Slide and rotate in coal to 1750' MD, out top of seam @ 1750'. Drilled to 1779' MD, attempt to reduce angle and bring bit back into coal unsuccessful. 9:45 PM TOH to check tools and BHA. Bit through floor @ 10:45 PM, bit #13 in good condition (reusable). No problem detected in tools/BHA. Pick up new mud motor and bit #14 GeoDiamond PDC model M208, serial no. JR3911. 11:30 start TTH, work drill casing back into Leg #1, stop in Poca seam #3 at 1700' to side track / reduce angle.
- 7/1 Begin side track of Leg #1 at 1700' MD/KB. Slide and rotate in coal reduced inclination and drilled coal from 1700' to 1832' MD/KB, out base of seam @ 1832' - 1862' MD. Drilled in coal seam #3 1862' to 2146' MD, out base of seam 2146' to 2158', back into coal 2158' to 2176' MD/KB, out base of seam 2176' MD building angle to return up into seam #3.
- 7/2 Drilled ahead in Leg #1 to 2866'. Scraped shale (out of seam) @ 2146-58' MD, 2175-94' MD, 2517-2934' MD. Severe weather lightning, stopped drilling one hour.
- 7/3 Drilled ahead in coal Leg #1. Drilled out of coal 3042' MD. Drilled ahead attempting to get into seam #3 to 3080' MD. Pulled 4 joints of drill pipe to 2934', reorient in coal seam and slide reducing inclination.
- 7/4 Drilled ahead in coal seam #3, Leg #1 to 3144' MD. 1:45 PM; TOH to base of 6" collars, pick up 20 joints 2 7/8" tubing TTH, run drill collars and resume drilling @ 7 PM. Drilled ahead in coal seam #3 to 3400' MD @ 7:00 AM. on 7-5-97.
- 7/5 Drilled ahead in coal seam #3, Leg #1, drilling slowed (out of seam @ 3491' MD). No longer able to slide or side track effectively, called total depth @ 3713'. Move air compressor to well site, circulate air down drill string clean up leg #1, TOH to leg #3, TTH (swivel in as needed) to TD @ 3182' MD, circulate w/ air, clean up leg #3. TOH, TTH to clean out leg #2.
- 7/6 Finishing up clean-out.

United States Steel Mining Co., Inc.

Drilling Summary

Bit record: (all 4 3/4")

Site / Model	Footage In-Out:	Rotating Hours:	Condition:	Misc:
1/ Smith W737F SB LM 5900	935'-1032' (leg2)	3	shanks worn/junk	Misc: Start in hole 6/11 AM, 2 magnet runs 13hrs.
2/ Smith W737F SB LM 8429	1032'-1197' (leg2)	9	shanks worn/junk	reamed & circulated fill
3/ Smith W715GP SB LM 3536	(1105'-1110') ream	1.5	shanks worn/junk	reamed & circulated
4/ Smith W715GP SB LM	(1110'-1180') ream	3?	slight wear/renewable	cleaned up to run @ 5/8" casing
5/ Smith W715GP SB LM	(1130'-1180') fill	2	shanks worn/runable?	drilled into vertical well 6/15/97 @ 3:25AM, 1603'WD-13 air insufficient volume/rate to clean hole
----- Run @ 5/8" casing -----				
6/ Smith W715GP SB LM	1180'-1656' (leg2)	12	shanks worn/junk	back drilling w/ air assist 6/17 @ 9AM
6/ Smith W715GP? SB LM3055	1250'-1354' (leg2a) (2a-side track)	8	shanks worn/junk	start drill collars 20hr. trip (work pipe & handling collars)
----- I.R./900 air compressors on location 87PM 6/16/97 -----				
7/ Smith W715GP SB LM3530	1249'-2103' (leg2a)	31	worn bearing & shanks/junk	Replace motor, bit & MWD 6/25 @ 6AM
8/ Smith W715GP SB LM3334	2143'-2315' (leg2a)	10.5	slight wear/renewable	16 hr. trip for bit #12 (work pipe)
9/ Smith W715GP SB LM3719	2315'-3079' (leg2a)	31	worn bearing/junk	TOD to check BHA, all OK. Run PDC bit
10/ Smith W715GP SB LM3532	3079'-3604' (leg2a) 1430'-1689' (leg3)	10 2 (19 total)	worn shanks/renewable	TD 7/5 @ 8:30AM, begin air cleanout
11/ Smith W715GP SB LM3529	1689'-2695' (leg3)	27.25	worn shanks/bearings/junk	
12/ Smith W715GP SB LM3512	2630'-3182' (leg3a) (3a-side track)	25.5	worn bearing/junk	
13/ Smith W715GP SB LM3721	1515'-1779' (leg1)	3.5	good cond./renewable	
14/ Smith W715GP SB LM3721	1780'-3713' (leg1)	62.5	condition ?	
15/ Smith W715GP SB LM3721	1780'-3713' (leg1)	62.5	condition ?	
Total rotating hours		248.75		

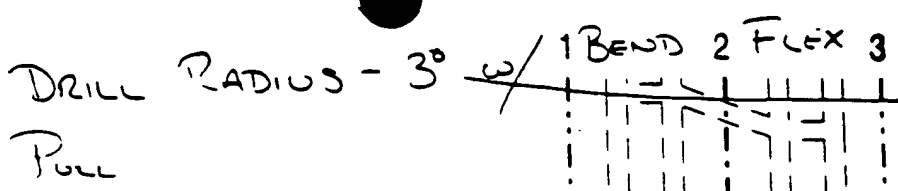
Observations / suggestions regarding the Articulated Well 8B-DD1a.

- Although hole conditions contributed to slow trip time, early on the rig was not set up for, and workers did not appear to be trained for efficient handling of drill collars, which resulted in slower than normal pipe trips in and out of the hole. Rig hands & tool pusher became familiar with how drilling rigs handle pipe/collars from Rich Moliski (Wilson Downhole Services), they then were able to set up tools and handle equipment more efficiently, improving trip times significantly toward end of operations. Rich should be commended for his successful efforts. The time he spent assisting, training and supervising the rig crew however, although helping the drilling operations run better, must have strained his effectiveness as Wilson Downhole Services directional driller.
- After the vertical well bore was penetrated on 6-15 @ 3:25 AM, the air package on site proved ineffective in circulating the horizontal well. Being that it was Sunday AM, the two compressors couldn't be brought in until Monday and they finally arrived @ 7PM. Air assist drilling didn't start until 6-17 (Tuesday morning) @ 9AM. During this 53hr+ time period, the rig drilled ahead 53' in the original hole and cut a 96' side track for the #3 leg, while waiting for air. In doing so the less than optimum bit performance was prolonged for another day+. Had the sufficient air been on site and ready Sunday morning, it is probable that the original hole would have been extended without the delay, saving a day of time and perhaps a bit.
- The lack of annular velocity necessary to carry cuttings to surface probably was the major cause of the excessive bit wear early on. Of the fourteen (14) bits used in the course of horizontally drilling, the average rotating time before 8 5/8" was run was about 4 hrs., after 8 5/8" was run: 10 hrs. and after 8 5/8" with air assist: the tri-cones averaged approx. 25 hrs. The PDC bit however, had much better run time (62.5 hrs), appeared to stay in the coal better than the tri-cones and the fishing/magnet runs for grease caps could have been avoided, had PDC bits been run instead of tri-cones. It would seem appropriate to try a PDC bit early on in the next well.
- The lack of pull down capacity reduced the ability to overcome drag, and therefore must have limited the potential horizontal extension of the legs. You are aware of this already.
- The plan view and cross sectional graphs plotting the course of the bit through the coal were referred to often while drilling and helped in anticipating changes in the dip of the coal seam.
- The geolograph (standard on most drilling rigs) was used extensively for reference as to depths, drill rates, and for recording purposes. The change in drill rates often indicated whether the bit was going out the top (gradual change) or out the base of the seam (a more rapid rate change).
- Although not conclusive, cuttings analysis was helpful in determining whether the bit was cutting out of the top or the base of the coal. Also iron visible in cuttings indicated potential bit or casing wear problems.
- A real time E-log such as a gamma ray log should be tried as an indicator of approaching top or bottom of seam, which would allow the bit to be steered earlier and avoid excessive dog legs. If this proved to be workable it would reduce bit wear (from drilling out of the coal) reduce drag and allow for more lateral extension in drilling of the legs.
- Other observations:
 - *Pet. Env. Tech., Inc. chemicals were effective in knocking solids out of the fluid.
 - *Well site was adequate in size, although if had been any smaller it would have resulted in reduced efficiency.
 - *Portable toilets were necessary and welcome by all who worked on location!

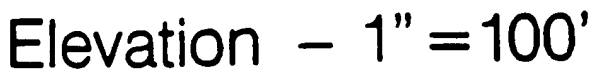
Joe, It was an interesting project to work with you on. I hope that my work met with your expectations and that these insights/suggestions are of help in improving future efficiency. Please call if you have any questions. Best of luck with the well(s).

Alex Sicilia.

Articulated Well 8B-DD1a Report Page 5



Plan View - 1" = 200'



8A Articulated Well #2

8B No. 1 Hole

Goal

Increase time spent drilling coal. Attempt to use analysis of return cuttings (mud logging) to make predictive assessments of when the bit is starting to leave the coal formation. Use rig with adequate weight on bit capabilities.

Problems

Last minute changes to well plan
No clear project oversight from WellTech (prime vendor)
WellTech rig was not set-up as required - make-up tongs
Wilson back-up directional hand inexperienced
Difficulty detecting when bit started to leave coal formation; mud logging inconclusive
Difficulty re-entering previously drilled sidetracks; cavity
Excessive tri-cone bit usage; required fishing job for bit cones and caps
Casing annulus too large; insufficient fluid velocity to carry solids
WellTech crews rotated throughout job
Problems with air; not enough pressure, no spare
Record keeping problems - missing sidetrack data
Bubble tube water level measurement becomes blocked
Low gas production due to damaged coal permeability

What went well

PDC bit held up well
Contract engineer supervision
Plotting hole path as drilling progressed
"Geolo-graph" rate of penetration (ROP) recorder kept record of rig performance
Portable toilets on location

Lessons Learned

All hole legs must pass through cavity; keep cavity hole close to articulated hole
Best indicator of bit location is ROP
Attempt to keep bit at top of coal seam; constantly slide "up".
Have planed plot of hole on large scale map on which to mark progress
Drill in inert environment; no oxygen, use bactericide in water
Do not use flocculent chemicals to clean pit fluid
When flushing holes with air, add 10 - 20 gpm fluid to prevent motor damage

8A No. 1 Hole

Goal

Demonstrate the feasibility of conducting methane pre-drainage activities from the surface using articulated drilling. Demonstrate a method to reliably de-water the horizontal well bore. Drill under balanced.

Problems

Wilson concurrence of well plan only at last minute
No clear project oversight from WellTech (prime vendor)
S.W. Jack rig was not set-up as required - make-up tongs/ dies; pull down capability
Wilson back-up directional hand inexperienced
Difficulty detecting when bit started to leave coal formation
Morning reports not available
Failed to reach target depth - torque & drag exceeded expectations
Flow Line not adequately secured
Rig floor progress plots were not kept up
Difficulty re-entering previously drilled sidetracks to clean holes
Pits leaked
Awkward vendor organizational structure - WellTech, Wilson, S.W. Jack

What went well

Perfect radius - intercepted +/- 2 ft of cavity
Pump jack de-watering pump system

Lessons Learned

Involve field crews in well planning process
Use contract field engineer to oversee drilling operations
Have flow lines buried
Use correct drilling rig for the job
Clean-up drilling fluid in order to detect changes in formation
Take decisive action when bit leaves coal; pull back and sidetrack
Use MWD to get into previously drilled holes to flush

8A No. 2 Hole

Goal

Use gamma log while drilling (LWD) device to predict when drill bit is about to leave coal formation. Test the use of electro-magnetic (EM) tool for survey data link. Attempt to duplicate production seen in 8A No. 1 Hole, while decreasing time (cost) of drilling.

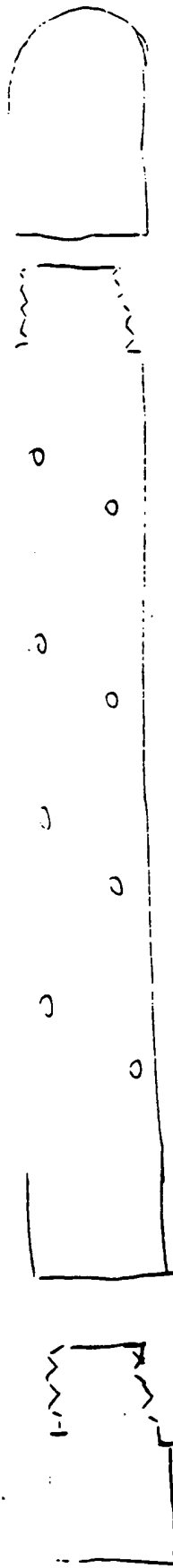
616

241 - 210

EXPLOSIVE CHARGE
LANDING DEVICE —
CAVITY HOLE COMPETITION

10' +/-

16



SUB —

2 7/8 EVE(?) - PH6
(FIBERGLASS THREAD) - PH6

THIN WALL 2-7/8"
FIBERGLASS
(PERFORATED w/ 1" HOLES)

BULL PUG
(FIBERGLASS)

9/24/97
DA 2.



United States Steel Mining Co., L.L.C.

FINAL REPORT

Well: Articulated Well 8A-DD-2a
State: West Virginia
County: Wyoming
Project: Coal Degasification
Elevation: GL: 1472.89 KB: 1475.0
Formation(s): Middle Penn. Allegheny / Poca Seam No.3
Spud Date: kick / 8-31-97
Final TD: Leg # 1=847'-3206'MD, Leg # 2=1111'-3233'MD, Leg # 3=793'-3680'MD
Total days Drillingkick: 13 / horiz.
Cost of directional well(approx): \$ 307,000.00
Cost of project drilling(approx): \$ 450,000.00

Date: Activity:

8/22-8-28 Waiting for purchase order (USM-Wilson negotiations)

-8/25 SWACO centrifuge & gas buster arrived at site, WellTech dozer assist turnaround truck.
Justice unload equip. & spot on location.

-8/27 Move Gene D. Yost & Sons rig #2 (Jasswell) in and spot equip.

-8/28 Move in steel pit and fill with Fresh water, set up gas buster/centrifuge.

8/29 Rig up rig & flowlines.

8/30 Welding up flowlines.

8/31 7AM start making up BHA, TIH w/ 4 3/4" bit, 3 deg. mud motor, subs, collars and tubing.
Start mud pump, fill hole, repair flow line leaks, replace swivel packing, start drilling @ 7:45
PM 8-31-97. Drilled from 589' MD to 624' MD. Got stuck during connection. Worked drill
string free @ 1:15PM. Repaired swivel leak, resume drilling angle.

9/1 Drilled angle taking surveys every 5' MD. Top of Poca seam #4 at 642' MD, Drilled ahead
to 703', circ BU, TOH. Lay down 3 deg. mud motor, and bit (bit #1 worn out), pick up
deg. mud motor and bit #2 4 3/4" Smith MF15GP (used @ 8B-DD-1A) BHA & TIH. R
hole last 20' +/- . Resume drilling 9PM 9-1-97. Drilled ahead to 717' MD. TOH to change
angle of motor. Pick up 4 deg fixed motor, TIH resume drilling 6:30 AM 9-2-97. Drilled
ahead cutting angle to 730' MD

9/2 Drilled angle taking surveys every 5' MD. Top of Poca seam #3 at 731' MD, Drilled on
bottom of #3 seam continued sliding ahead to 773', circ BU, TOH. Lay down 4 deg. mu
motor, and bit (bit #2 fair cond.), pick up 1.5 deg. mud motor and bit #3 "PDC" type,
3/4" GeoDiamond M20S, (recond. from 8B-DD-1A) BHA & TIH. Drilled ahead to 832' MD
missed target. Evaluated data, drilled ahead to 845' set drillstring at bottom, MIRU Down
(from nearby job) pumped 22bbls fr. water attempt to frac into vert hole. Not successful
Pick up drillstring, TOH stop and resurvey hole from bottom to top.

- RUJavins Directional Surveys wireline truck, run gyro RDMO Javins, evaluate results. TIH with open ended tubing, MIRU Dowell; spot 60 sack kick plug @ 844' MD. Break circ. w/ 12.5 bbl fw, mix 60 sacks at 15.6 - 16 ppg, 12.5 bbl slurry C¹A¹ cement 2% CaCl₂, plug down 12:40AM, 9-4-97. Remove Dowell connection, rig pulled 12 jts, hook up swivel and circ. 1/2 hr @ 480'; returned approx 10 gal cement water after 4 min. TOH. WOC.
- WOC, TIH w/ bit #4 [Smith MF37DP, SN LM5973] tag cement at 480'. Drilling cement @ 10:40AM, drill to 584', TOH moderate wear on bit #4. Pick up 4 deg mud motor/BHA, TIH, begin kick @ 4PM 9-4-97. Drilled ahead to 667' MD, POCA seam #4 @ 653'-656' MD. TOH to change bit & motor. Bit #4 shanks worn. Pick up bit #5 [Smith MF37DP, SN LM5973] 2.12 deg mud motor/BHA & TIH. Drilled ahead to 707' MD, circulate to trip for higher angle mud motor.
- 9/5 TOH w/ bit #5 & 2.12 deg motor, pick up 3 deg motor & TIH rerun bit #5. Drilled ahead to 731' MD, TOH lay down 3 deg motor, pick up 4 deg. motor & TIH. Drilled ahead to 793' MD, TOH lay down 4 deg motor and bit #5 (worn on shanks, rerunable), pick up bit #6 [RERUN GeoDiamond M20S JR3911A], 1.875 deg mud motor/BHA & TIH, Drilled ahead to 808' lost circulation. Start air compressor on vertical hole, could not unload articulated well. Pump fluid into art. well, circulated up out of vert. hole, bring on air and surge back out of art. hole. Unloaded art. well.
- 9/6 Drilled ahead past vert. hole, began turn and head due East at approx. 1615' MD. Drilled due East to 2481' MD, in POCA seam #3.
- 9/7 Drilled ahead due East in leg #3 to 2733'. Pulled 10 joints to check drag of drill string, unload hole with air, (guess) estimate gas rate @ approx. 70-100 MCFPD rate, water @ approx. 8-10 GPM rate (+/- 300 BPD). TIH and resume drilling. Drilled ahead in POCA Seam #3 to 3427' MD, (occasionally scraping top and bottom shale beds).
- 9/8 Drilled ahead due East in leg #3 to 3680' MD. Pulled 80 joints to start leg #2. Kick off at 1111' MD, drill azimuth to get due East, cut corner approx 49' wide. Drilled ahead in POCA Seam #3 in leg #2 to 1944' MD.
- 9/9 Drilled ahead in POCA Seam #3 in leg #2. Well making water while drilling at approx. 20 BPH. Justice vacuum trucks hauled 4 loads off of reserve pit. Drilled to TD of leg #2 3233' MD, @ 2:05AM 9-10-97. Circulate TOH to check bit and replace mud motor.
- 9/10 TOH to check bit and replace mud motor. Bit #3/6 in v. good condition one chipped tooth. Pick up new mud motor w/ 1.875 deg < BHA TIH to 847'. Begin kick for leg #1, (North leg). Drilled ahead in POCA Seam #3 in leg #1 cut turn to due East. Well made approx 10 Bbl/hr. water while drilling. Justice vacuum trucks hauled fluid off of reserve pit & hauled in 3 loads of gravel. Drilled ahead in leg #1 to 2072' MD @ 8AM 9-11-97
- 9/11 Drilled ahead to 3206' MD TD of leg 1 @ 12:50AM 9-12-97. Circulated clean fresh water to clean up leg. TOH w/ 99 joints (2 7/8" x 8.7#/PH-6) tubing and BHA, lay down motor, bit, bent sub, monell collars, pick up bent joint tubing, getting ready to TIH @ 8AM
- 9/12 TIH w/ bent joint tubing, MWD tools, and tubing to approx. 1500' MD, circulated clean fresh water to clean up leg #3. TOH to 1111', TIH into leg #2 circulated clean fresh water to clean up leg #2. TOH lay down tubing BHA. Flow test vertical well at 250 MCFD + rate while TIH. Out of hole @ 2:30AM 9-13-97. RDMO Yost rig; stacked on location.

**United States Steel Mining Co., Inc.
Drilling Summary**

d: (all 4 3/4")

/ Model	Footage In-Out:	Rotating Hrs:	Condition:
Smith MF37DP (new) SN LM 5974	489'-703' (curv)	3.5	shanks worn/junk
2/ Smith MF15GP (used) SN LM 3721	703'-773' (curv)	3.5	shanks worn
3/ GeoDiam'd M20S(refurb) SN JR3911	773'-844' (failed leg)	1.5	excellent condition
4/ Smith MF37DP (new) SN LM 5973	484'-583' (dress cmt)	6.2	shanks worn/junk
5/ Smith MF15GP (new) SN LM 3477	583'-793' (curv)	3.5	shanks worn
6/ GeoDiamond M20S (rebuilt) SN JR3911 (bit 3 rerun)	793'-3680' (leg 3) (27.0) 1111'-3233' (leg 2) (11.75) 847'-3206' (leg 1) (15.5) Bit #6 total= <u>54.25</u>		V. Good condition +
Total articulated well rotating hours =		72.45	

Observations (Improvements from last well):
-Bits/drilling improvement:

- The PDC bit proved to be highly effective:
 - *in terms of drill rate, even in the beds above and below the coal seam/
 - *as far as durability; after 55.75 rotating hrs. it only had minor wear and could have conceivably been used to drill much longer. This eliminated many trips which would otherwise have been necessary (as in the 8B-DD1a).
- Only 5 bits were used in the drilling of this well; (3 without the plugged missed attempt) This compares with 14 bits used in the 8B-DD-1a, although other factors such as length of curve / radius and amount of highly abrasive rock penetrated contributed to the problems at the 8B-DD-1a.
- The shale shaker and centrifuge proved effective eliminating solids from being pumped back down the drillstring which was probably a contributing bit wear factor in the last well.
- 7" casing allowed higher annular velocity for more effective solids removal from the hole. The lower annular velocity attained in the 8B-DD-1a's 8 5/8" casing was also a possible contributing factor to ineffective cuttings removal and resulting bit wear and drillstring sticking and drag problems there.
- Pull down improved drill rate, overcame drag and allowed for greater extension and made the use of cumbersome drill collars unnecessary.

-Directional Guidance Accuracy Improvements:

- Gamma Ray tool allowed dir. driller to adjust angle of the bit path quicker and with more certainty, Shale shaker also resulted in better samples as indications of what was being drilled.
- As in the last well the geologist helped for reference as far as depth, formation/drill rate and also for bit hour data and work recording purposes.
- Graphing plotting of surveys:
 - The Cross section was replaced by the GeoServices' GR/TVD well plot. This was high accurate and readily usable, and was an enormous help as compared to the 8B-DD-1 where the plots were interpretations limited by poor samples and inexact drill rate information.

Suggestions/Recommendations:

- *** Put liner under the centrifuge and shaker and direct the slope so that any leaks overs will drain into the reserve pit to avoid fluid escape off location.
- *** Set up pump/hose which can be utilized to jet/clean pits as needed.
- *** Continue the practice of stacking the tubing so that it can be handled efficiently, b out of the dirt/mud and can be tallied more easily.
- *** As was mentioned in the well site meeting Friday 9-12-97: Keep regular communication and reviewing of data between dir. drillers and MWD operators so that driller can respond more quickly when MWD info indicates a poss. "wrong turn" course.
- *** Also as suggested by Rich Molski, more frequent surveys, although adding to the drilling time, could avoid or reduce wrong turns.
- *** MWD continue to regularly update slope information (using top/bottom projections TVD/ MD) to assist dir. driller in choosing the correct angle, and for reference useful subsequent legs.

view plot generated in MWD trailer course. In this connection, I recently heard someone say as an additional reference. In this connection, I recently heard someone say "a picture is worth a thousand words". project state appropriately that, "a picture is worth a thousand words".

Near term, future innovation to consider:

- ** replacing the present tubing thread type with a type which allows for quicker handling during make up and break out operations, while being as effective and durable in directional operations as the hydril PH-6 thread is.
- ** using a pit with a bottom door, (in conjunction with a liner properly sloped to the reserve pit) allowing for more efficient/less time consuming pit cleaning.

Long term, future innovation to consider:

- * look into a directional GR tool and reduction of distance between bit and MWD/GR tool.
- * look into a pull down rig with derrick which would save some time in handling pipe and MWD tools.

Joe,

Once again it has been very interesting working with you on this project. It was also very rewarding for me to see the implementation of previous recommendations improve the operation so dramatically. I am very pleased to have assisted you in that area. I hope that the degas project continues to improve as I expect it will. Please feel free to call me or Rod if you need any assistance, advice or if you have any questions regarding this project or report.

Best of luck with the well(s).

Alex Sicilia

Alex Sicilia
Consultant

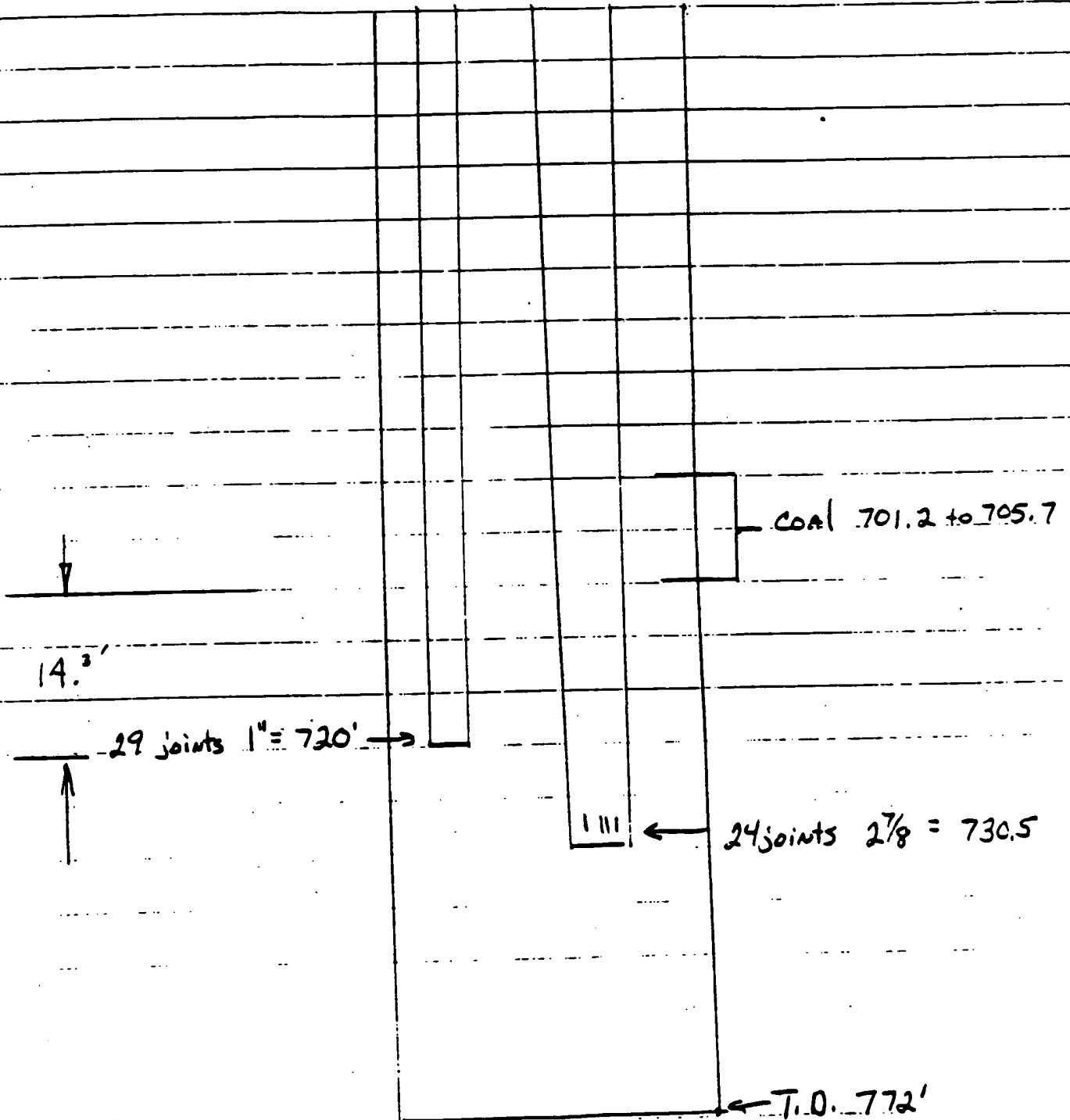
BEFORE
12/18/97

D.W. 3 - 8A002

Large barrel pump

coal 701.2 to 705.7 T.O. 772'

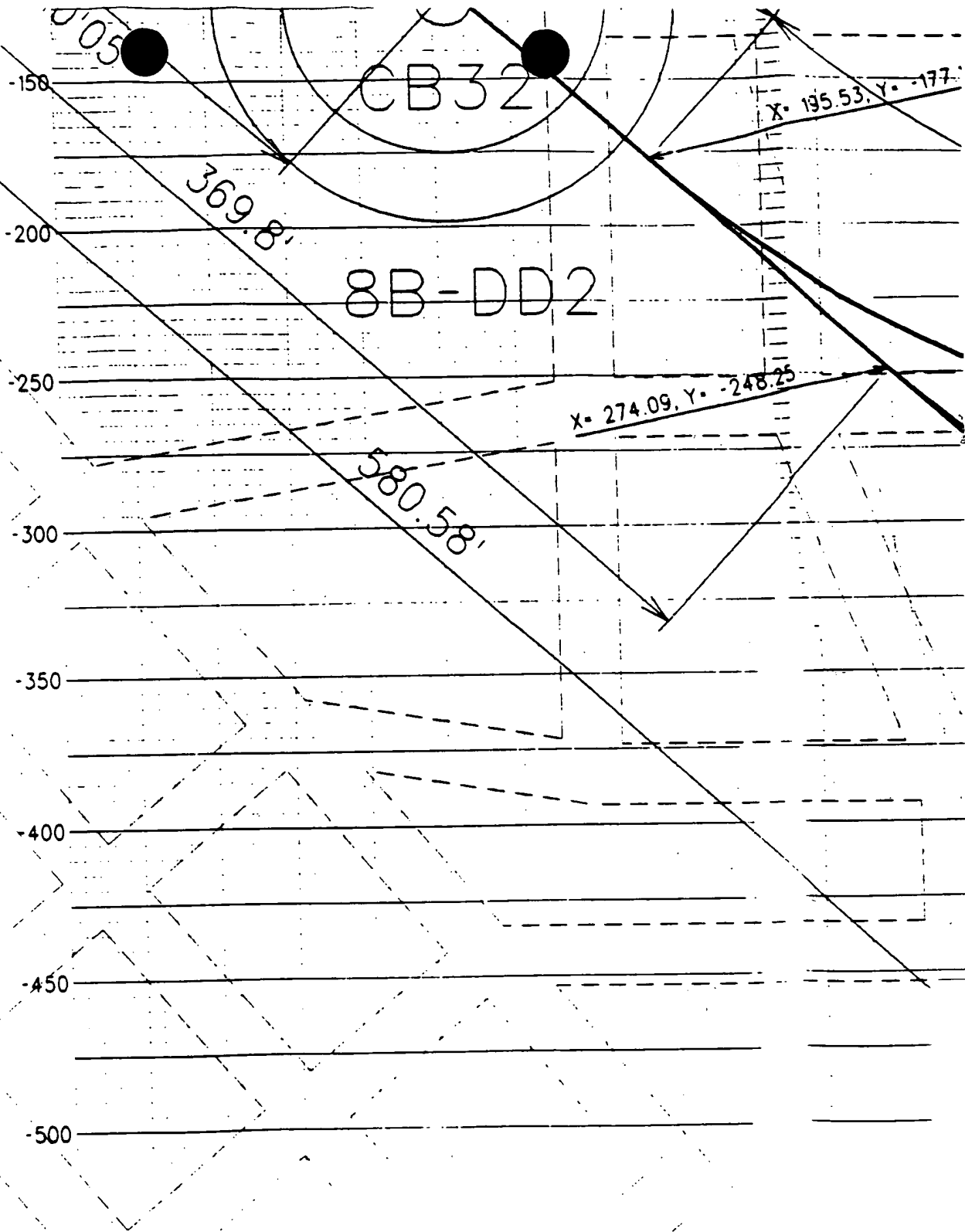
24 joints $2\frac{7}{8} = 730.5$ 29 joints $1" = 720'$ 28 $\frac{3}{4}"$ rods



8B No. 2 Hole

Goal

Reduce cost of drilling operation by reducing non-productive time. Look for further efficiencies in drilling operation. Test extended reach (3200 feet) effect on torque and drag. Test well performance (gas flow) after drilling each leg. Evaluate the need to re-clean all holes after all drilling is complete.



Well Plan 8B No. 2 Well

see attached survey sheet for course description

Leg 1 (First to be drilled)

Begin radius at hole TD (est. 625 measured depth). Drill with adjustable motor set to 3 degrees. Overall build rate in radius is 45 degrees/100'.

Enter top of coal seam. Trip out and switch to 1-1/2 degree bend motor.

Continue drilling to intercept cavity. Begin under balanced drilling.

After cavity, drill at AZ=132.17 for 400 feet. Begin left turn to Az=90 with 14.29 degree / 100 feet build rate.

Drill to 4826 md on 90 degrees azimuth.

Leg 2 (second to be drilled)

Pull back and side track at 1082 md. Begin left turn to 90.0 degrees azimuth with a 14.29 degree/100' build rate. (Turn may be begun 30 feet early if build rate is questionable).

Drill to 3952 md on 90 degrees azimuth.

Leg 3 (last to be drilled)

Pull back and side track at 912 md. Begin left turn to 90.0 degrees azimuth with a 14.29 degree/100' build rate. (Turn may be begun 30 feet early if build rate is questionable).

Drill to 4714 md on 90 degrees azimuth.

Clean out

Trip out and remove motor. Use 2 degree bent sub and clean out holes 1 and 2.

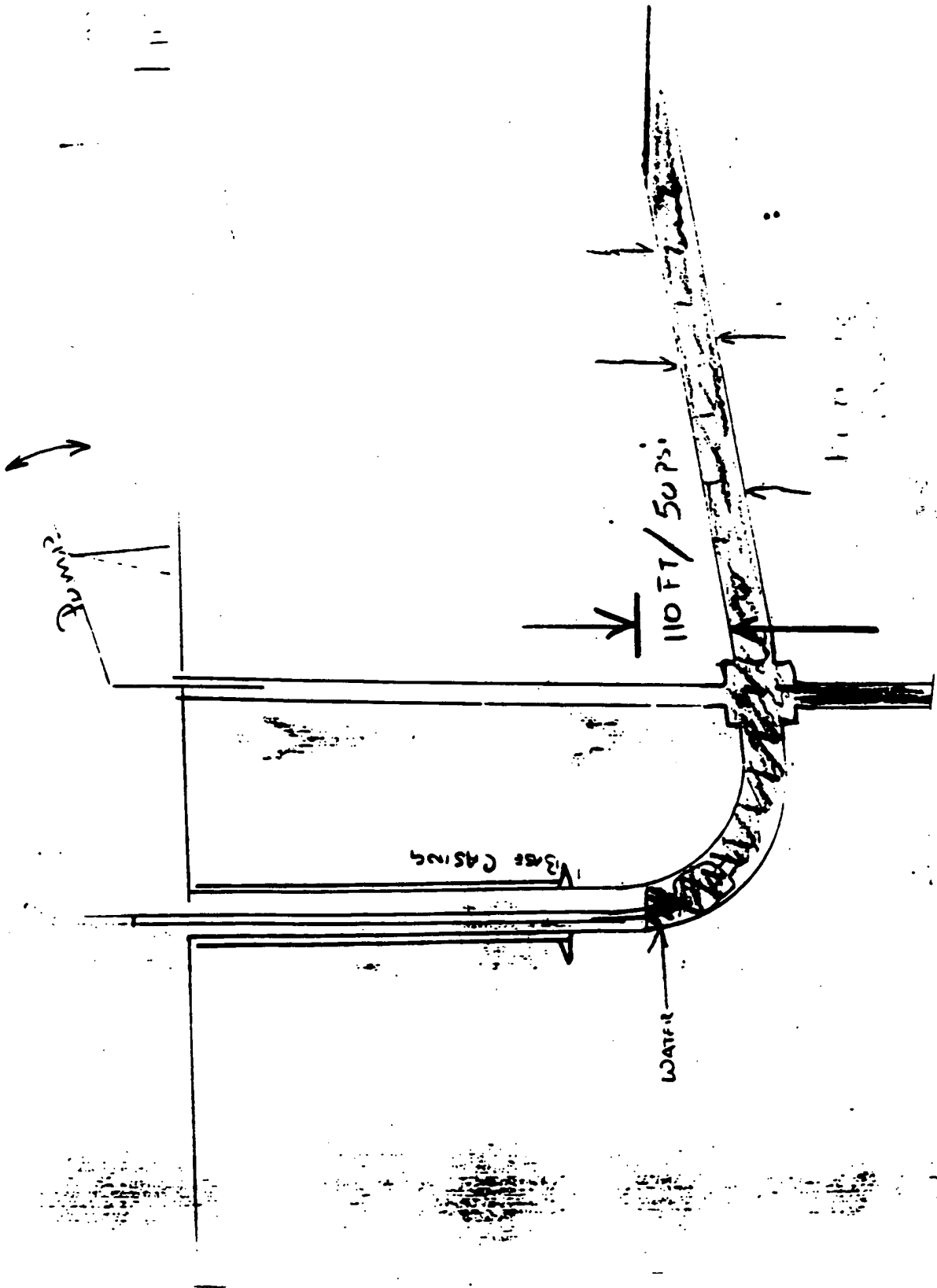
"A"

1000

1000

1000

MINE



9-Oct-97

WILSON DOWNHOLE DIRECTIONAL SERVICES

Page 1

DIRECTIONAL DRILLERS

RICHARD MOLSKI & KEN MCINTYRE

MWD/UNITED GEOM M.BRINDSON & D.GROELLE

U.S.STEEL MINING CO. LLC.
8B-DD2 GREEN HOU Hollow
WYOMING CO. WEST VIRGINA
LEG # 3

Vert. Sect. Dir. = S 47.8333 E Calculations using the Radius of Curvature Method

Meas. Depth	Hole Ang.	T.V.D.	V. S. Dist.	Hole Dir.	Total Lat.	Coordinates Dep.	C L O S U R E S Distance Direction	D. L. Sev
949	92.18	758.50	234.12	S 40.80 E	162.41 S	168.78 E	234.23 S 46.1019 E	.00
954	91.38	758.34	239.09	S 42.40 E	166.15 S	172.10 E	239.21 S 46.0079 E	35.76
969	91.00	758.03	254.04	S 44.10 E	177.07 S	182.37 E	254.19 S 45.8453 E	11.62
986	91.43	757.67	271.02	S 46.40 E	189.03 S	194.44 E	271.19 S 45.8080 E	13.76
1001	92.43	757.17	286.01	S 48.10 E	199.21 S	205.45 E	286.17 S 45.8835 E	13.14
1018	93.00	756.36	302.98	S 50.80 E	210.25 S	218.35 E	303.12 S 46.0832 E	16.21
1033	92.63	755.62	317.92	S 53.00 E	219.49 S	230.14 E	318.03 S 46.3567 E	14.85
1048	90.25	755.25	332.82	S 55.90 E	228.21 S	242.34 E	332.88 S 46.7200 E	25.02
1063	88.75	755.38	347.61	S 58.80 E	236.30 S	254.97 E	347.63 S 47.1760 E	21.77
1080	89.07	755.70	364.23	S 60.90 E	244.84 S	269.66 E	364.23 S 47.7626 E	12.49
1095	90.18	755.80	378.79	S 62.70 E	251.92 S	282.88 E	378.80 S 48.3129 E	14.12
1112	91.68	755.52	395.13	S 64.70 E	259.46 S	298.12 E	395.21 S 48.9667 E	14.70
1127	92.38	754.99	409.39	S 66.90 E	265.60 S	311.79 E	409.58 S 49.5739 E	15.33
1143	91.13	754.50	424.29	S 71.40 E	271.29 S	326.73 E	424.68 S 50.2967 E	29.18
1158	90.82	754.24	437.88	S 74.30 E	275.71 S	341.06 E	438.57 S 51.0481 E	19.45
1174	90.63	754.04	452.02	S 77.00 E	279.68 S	356.56 E	453.16 S 51.8902 E	16.91
1189	91.25	753.79	465.00	S 78.80 E	282.82 S	371.22 E	466.68 S 52.6977 E	12.68
1206	91.38	753.40	479.30	S 82.30 E	285.61 S	387.99 E	481.77 S 53.6419 E	20.60
1221	91.32	753.05	491.44	S 85.30 E	287.23 S	402.89 E	494.80 S 54.5142 E	20.00
1237	89.50	752.94	503.77	S 89.50 E	287.96 S	418.87 E	508.30 S 55.4932 E	28.60
1252	88.40	753.21	514.64	N 86.80 E	287.60 S	433.86 E	520.53 S 56.4600 E	25.73
1269	87.50	753.82	526.17	N 83.00 E	286.09 S	450.78 E	533.90 S 57.5983 E	22.96
1284	88.63	754.32	535.82	N 81.50 E	284.07 S	465.63 E	545.45 S 58.6138 E	12.53
1300	89.57	754.58	545.83	N 80.30 E	281.54 S	481.43 E	557.71 S 59.6809 E	9.50
1315	90.00	754.63	555.04	N 79.80 E	278.95 S	496.20 E	569.24 S 60.6568 E	4.41

December 12, 1997

To: Earl Cook
Boney Stacy
Jay Martin

From: Joe Zupanick

Subject: DW-4

In planning for the unexpected, please consider the following regarding the de-watering pump at DW-4:

When a pump failure occurs in a normal articulated hole: Residual reservoir pressure will continue to flow coal seam produced water into hole. Water builds only to residual coal pressure level (say 110 feet), then water flow into hole stops. (See diagram "A").

When a pump failure occurs in the DW-4 hole: Water inflow is from aquifer far above coal. Water level in the hole continues to rise past reservoir pressure. Water begins to infuse coal; water level continues to climb to 500'. Pressure on packer in mine exceeds 200 psi. (See diagram "B").

Rather than use low pressure "balloon" type packer, I suggest we use conventional "thru" type (TAM) packer to seal the hole. If surface pumping unit goes down, it will take 16 - 24 hours to change it out. During that time, we need to plumb the packer to 2 inch hose, and route the hose to return entry. Open the valve on the packer and allow water (and some gas) to flow out of borehole through packer, into return entry. Excessive water pressure would be kept off of the coal and the packer, thus preventing the "blow out" experienced with "balloon" type packers in the past. (See diagram "C").

Location Plat - 8B Articulated DeGas Wells - No.2 Installation

Surveyed: 8B-DD2a - 07/16/97; 8B-DD2 - 08/15/97

8B-DD2a (Articulated DeGas)

North 53665.207

East -3261.245

Elev. 523.75 n/a Topo Elev.

Coal El. 759.6

162.2 total depth of cover

8B-DD2 (Vertical DeWater)

North 53569.398

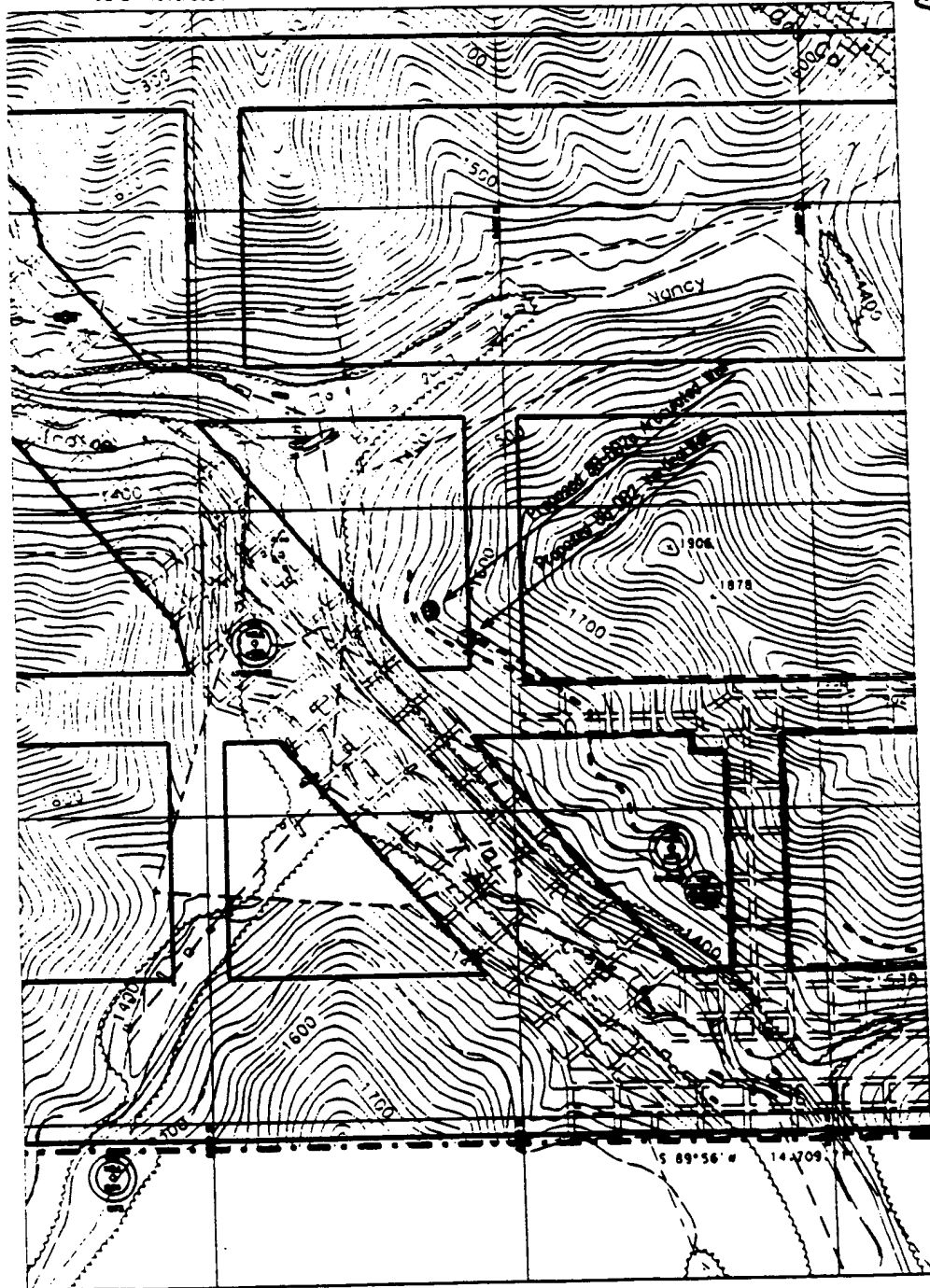
East -3145.061

Elev. 1519.44 n/a Topo Elev.

Coal El. 759.3

160.1 total depth of cover

*NOTE: DEPTH OF
ARTICULATED BOON
TO BE DETERMINED
VERTICAL DeWATER
BOREHOLE TO HAVE 3
CAVITY.*



Prepared By:

Approved by (USM)

8-31-97
8/31/97

DW- 5

Comments from previous projects

Start drilling with pits empty rather than full.

Use more accurate method to line up subs (laser).

Have compressors plumbed to hole prior to start of project.

Find method to survey closer to bit.

Have telephone in MWD trailer,

Plan location, design lay-out of equipment.

~ Have fiberglass joint ready for explosive charge.

~ Remember, side tracks in coal drop angle.

Make target well above the coal seam.

Verify tool inspection for every connection that enter the hole.

Perform safety checklist prior to start of job.

Have pipe racks or tub on location at start.

When drilling coal, view MWD gamma / TVD plot every 30 feet (minimum).

DW- 6

Comments from previous projects

Poor Start-up; Centrifuge plugged from not washed clean on previous job.

- Pumps need suction strainer to prevent leaves/trash from being pumped down hole.

Tank needs to be agitated so that centrifuge can continuously clean fluid.

- Drilling must stop when solids control is not functioning.

Communications! Must have telephone contact.

First shot was not landed at correct depth.

Second shot (Austin powder) didn't have enough force. (10 feet of 1-1/4" permissible):

Third shot didn't land correctly. Should have re-run another fiberglass joint.

Need to keep better recordsmotors changed out at what depth.

What type of motor are we using? Do we know what flow rate we should be using?
We are using 90 gpm... why?

Fiberglass joint need to be well perforated.

First radius overshot cavity... waited too late to change over to 1.88 motor.

Need to have progress meeting with project engineer at 30° 45° and 60° of angle

- Running upside down worked well, need to recognize effect of magnetic of motor.
- Don't put locations on top of the mountain. Too much TVD.

Look for air lift valves.

- MWD - 5 trips for MWD, (4) failures, (1) software

Cavity and Radius holes are too close together. Space further apart. Find cavity by side track rather than explosives.

Attempt to sidetrack into cavity ... projected build only gives 4 feet of distance. (Why attempt for 4 feet).

Fire Drill - Conduct fire drill... Where are extinguishers; How many are available?

Need third driller, especially while building radius.

Have Float sub made to minimize distance from survey tool to bit (Acme x PH6)

Have phone communications with rig at any remote cavity hole site.

Use pressure rated rotating head (400 psi min.)

Remember - build rate drops in last 30 feet above the coal. All but one hole has gone into the bottom. Average total build rate for top section of hole is 52 / 100'.

Survey at closer interval while approaching cavity.

Use the predicted average grade as a guide to steer up or down. Don't wait for gamma to indicate that we left the coal seam.

Have pressure gage on air lines. Gage on air compressor reads minimum unloading pressure.

All wells have lost azimuth angle in radius. Compensate from the beginning. Take immediate and decisive action to correct azimuth drifting from target.

Recognize battery life is not what we expect. Plan to change out during trips.

Need spare air compressor plumbed into system.

Welding on flow lines - Test with CH₄ meter prior to cutting and welding. Be sure of environment within vessel or pipe before welding.

Plug ports on well head to keep rocks and debris from entering well.

Use collar below wellhead to restrain inner string on cavity hole.

Cement Jobs - Use 100 percent excess, circulate fluid in hole, cement, pull up, circulate out excess.

Calculations - Have calculations reviewed (checked) by others.

Smith Bits - rock bits don't seem to last as well as some others

Change Motors - Always some correction in tool face.

Running survey tool upside down - Apply correction for magnetic influence. Re-run surveys when tripping back in hole with 1.88° motor and proper non-mag spacing

Set steel pit on solid ground away from steep slope. Have pit level.

Run Gyro Surveys of both holes prior to start.

Verify the cavity is drilled to full 8' diameter.

Freeze protect water handling equipment. What isn't protected, install with grade and drains.

Documents - IADC rig activity sheet filled out accounting for every hour. Slide & rotate sheets kept in dog house and provided with survey data at the end of the job.

Use float valve above motor to keep from pulling "wet string" while drilling curve.

General Comments From Wilson:

Need oil-field type drill rig w/ 24 hour staff

Re-design drilling pit

Contract structure

Staff:

1 project engineer / one site supervisor

2 directional drillers

2 mwd operators

4 rig hands

WellTech must verify cavity completion to full diameter

Reserve pit on same elevation as location

Safety floatation device in reserve pit

Begin radius 120' off top of coal. Drill with 4° motor

Winter drilling... keep air on location to blow out flow line.

DAILY DRILLING REPORT

Report No.: 6

Date: 2/27/98

COMPANY:	U. S. Steel Mining Company	RIG CONTRACTOR:	CHAP RIG # 8
FIELD:	Pineville	WELL NAME:	DW-7
LOCATION:	Pineville, West Virginia	SHA NO.:	1
DEPTH:	588	FOOTAGE:	74
SIZE:	4 7/8	LAST CSG DEPTH:	487

BIT DATA

BIT NO.:	1	MFG.:	Smith	TYPE:	MF5DP	CUM. FOOTAGE:	74	DEPTH IN:	5
SIZE:	4 3/4	SERIAL NO.:	LP5256	JETS:	3-16s	CUM. HOURS:	0.75	DEPTH OUT:	5
DULL COND.:	IR:	OR:		LOC:		COMMENTS:		AVG. R.O.P.:	
GAUGE:	DC:	OC:		RPLD:					
BIT NO.:		MFG.:		TYPE:		CUM. FOOTAGE:		DEPTH IN:	
SIZE:		SERIAL NO.:		JETS:		CUM. HOURS:		DEPTH OUT:	
DULL COND.:	IR:	OR:		LOC:		COMMENTS:		AVG. R.O.P.:	
GAUGE:	DC:	OC:		RPLD:					

MOTOR DATA

DHM NO.	1	SIZE:	3 3/8	BEND ADJ	4"	STABILIZER O.D. IN.		DEPTH IN:	514
CIRC. HRS. TODAY:	0.75	SER NO.:		PDM168		CROWN LGTH IN.		DEPTH OUT:	5
CUM. CIRC. HOURS:	0.75	TYPE:		PDM		BIT TO BEND LGTH:	3.15	CONDITION:	
DHM NO.		SIZE:		BEND ADJ		STABILIZER O.D. IN.		DEPTH IN:	
CIRC. HRS. TODAY:		SER NO.:				CROWN LGTH IN.		DEPTH OUT:	
CUM. CIRC. HOURS:		TYPE:				BIT TO BEND LGTH:		CONDITION:	

PUMP DATA

PUMP:		S. P. M.:	31	VOLUME/G.P.M.		94.5	
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MUD DATA

MUD WT.:	Water	VIS.:		WL:		TYPE:		TEMP. F.	
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TIME BREAKDOWN

00:00 HRS. THRU 24:00 HRS.

FROM	HRS.	
0:00		
00:30	.5	Work on swivel packing and 4" valve
01:30	1	Pick up P-105
02:15	.75	Test MWD
02:30	.25	PAU P-8
03:45	1.25	Install Rotating Head
05:00	1.25	Level Rig and fix 4" valve
06:00	1.0	Test Mud
06:15	.25	Work on Pump
07:00	.75	Test MWD (will not synch)
08:00	1.0	Rig up wire line to pull MWD
09:00	1	Break wire line Trip out of hole
10:00	1.0	Change out MWD tools (stuck in first joint of drill pipe)
11:00	1.0	Run in MWD and test
11:15	.25	Trip in and install back brake
12:30	1.25	Drilling by sliding from 514' to 588'
22:00	7.5	Trip out of hole to change out motor
23:00	1.0	Lay down rotating head Break top drive sube and pick up elevators
23:45	.75	Lay down P-105
24:00	.25	Lay down MWD

Bent Leggett on Location 2/27/98

YESTERDAY'S COST:		CO. REP.:	
TODAY'S COST:		DIR. DRILLER:	Bernie Bell
TOTAL CUM. COST:	\$	DIR. DRILLER:	Darrell Bednorz
		MWD OPER.:	Jim Turney / Tom Shyr

Ben L. Igitt

CDX GAS

3400 Madison Rd. Suite 200
Dallas, Texas 75240
(972) 380-1200

February 16, 1998

Joe Zuparko
U.S. Steel Mining
Central Division
Box 338
Pineville, West Virginia 24674

Dear Joe:

CDX is pleased to offer and recommend a wellsite consultant for the on-going drilling program at Pineville. As we discussed, this consultant should provide short-term benefit to you on the drill wells prior to CDX's pending operation, and also provide excellent transition to CDX in the coming weeks.

CDX has executed a contract with the consulting company Energy Operators, Inc. CDX proposes to pass-through the costs of this consultant with no mark-up. The rates for the consultant are as follows:

Stand-by Rate: \$375/day

Customer Representative (Beginning February 21, 1998): \$750/day

Travel time is to be included as paid time

Expense Reimbursement (hotel, motel, food, communication, airfare; all will have receipts)

Personal automobile mileage to be billed at \$0.60 per mile.

Please signify your acceptance of this arrangement below.



John G. Elund, CDX Gas



True Line, Incorporated

FEB 16 '98 17:22

10/10/9

FEB 17 '98 13:23

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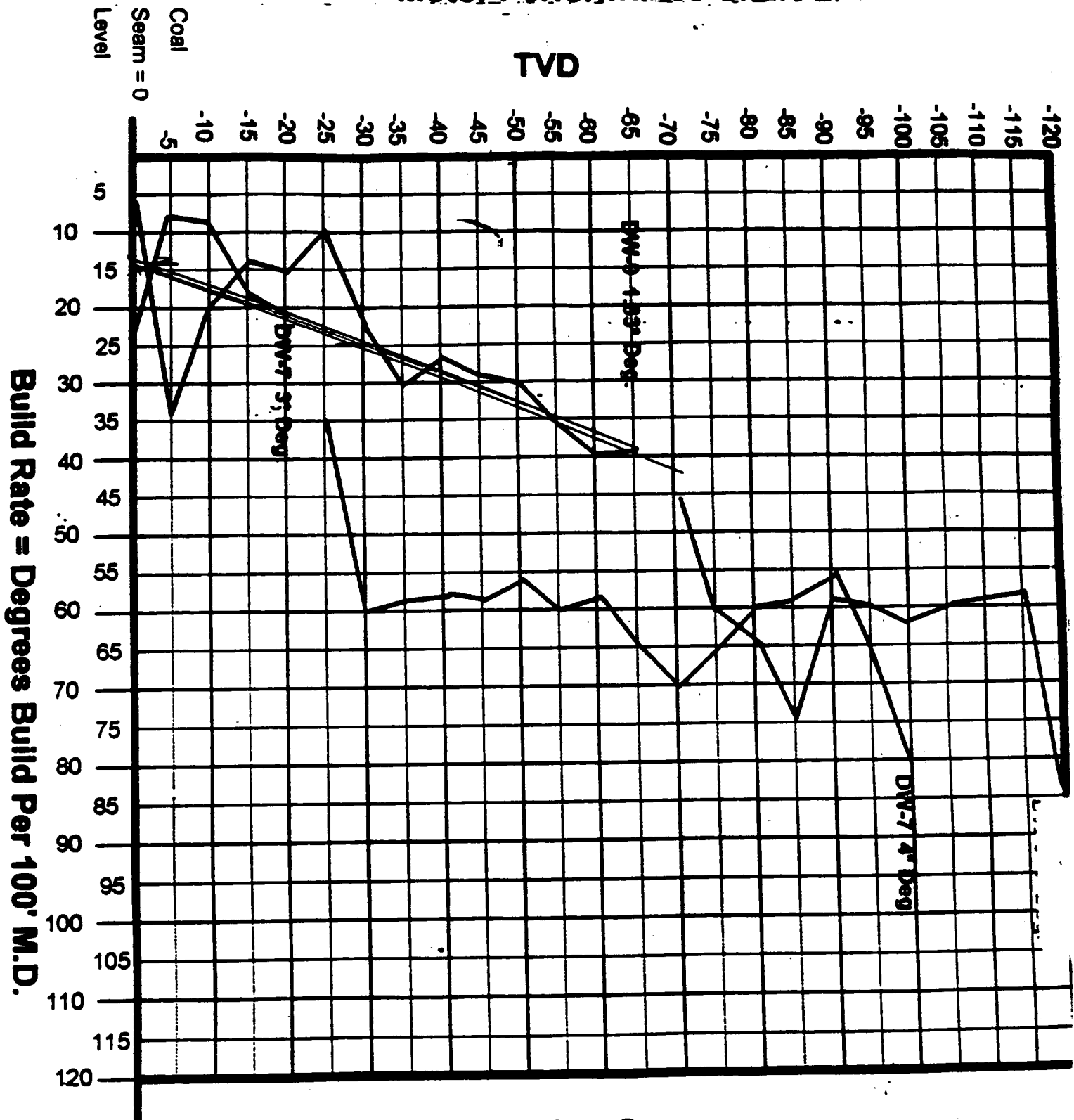
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3/20/98

Project Summary - DW-9

- Have well head below ground level prior to MIRU.
- Have plats, coordinates, and well diagrams prior to start of well.
- Accurately correlate position of Pocá 4 Seam while drilling. Do not attempt to re-log with bit turning.
- Start curve with 4 degree motor 5 feet lower (105 above coal). Consider designing curve for 3 degree motor. Can we get a 3.5 degree motor?
- Need summary of build rates for 1.8, 3.0 and 4.0 degree motors at different intervals (coal, immediate roof & floor rock, main roof rock). Too much guessing about performance while good historical data exists.
- Have flow lines to gas buster set up with cut-off valve in order to test connection with cavity well.
- Have swedge on hand in order to pressure up on well to connect with cavity if necessary.
- Safety line in pit.
- Have extra rig phone at steel pit and at off site compressor location.
- Modify steel pit (shorter).
- Install pressure gage in air compressor lines. Record pressures in rig report daily.
- Have water pump at creek supply water. Don't pay to haul water 300 feet.
- Keep bactericide in pit water. Add ½ jug per day. Record in rig report daily.
- Blow line (air) from gas buster must be steel. Line must be very short or be restrained.
- When drilling greater than 3000' MD, additional time spent in 15' check shots may be worth while.
- Well becomes over-balanced at 4100' MD (pits loose water). What is annular pressure at this depth?

Motor Performance Chart



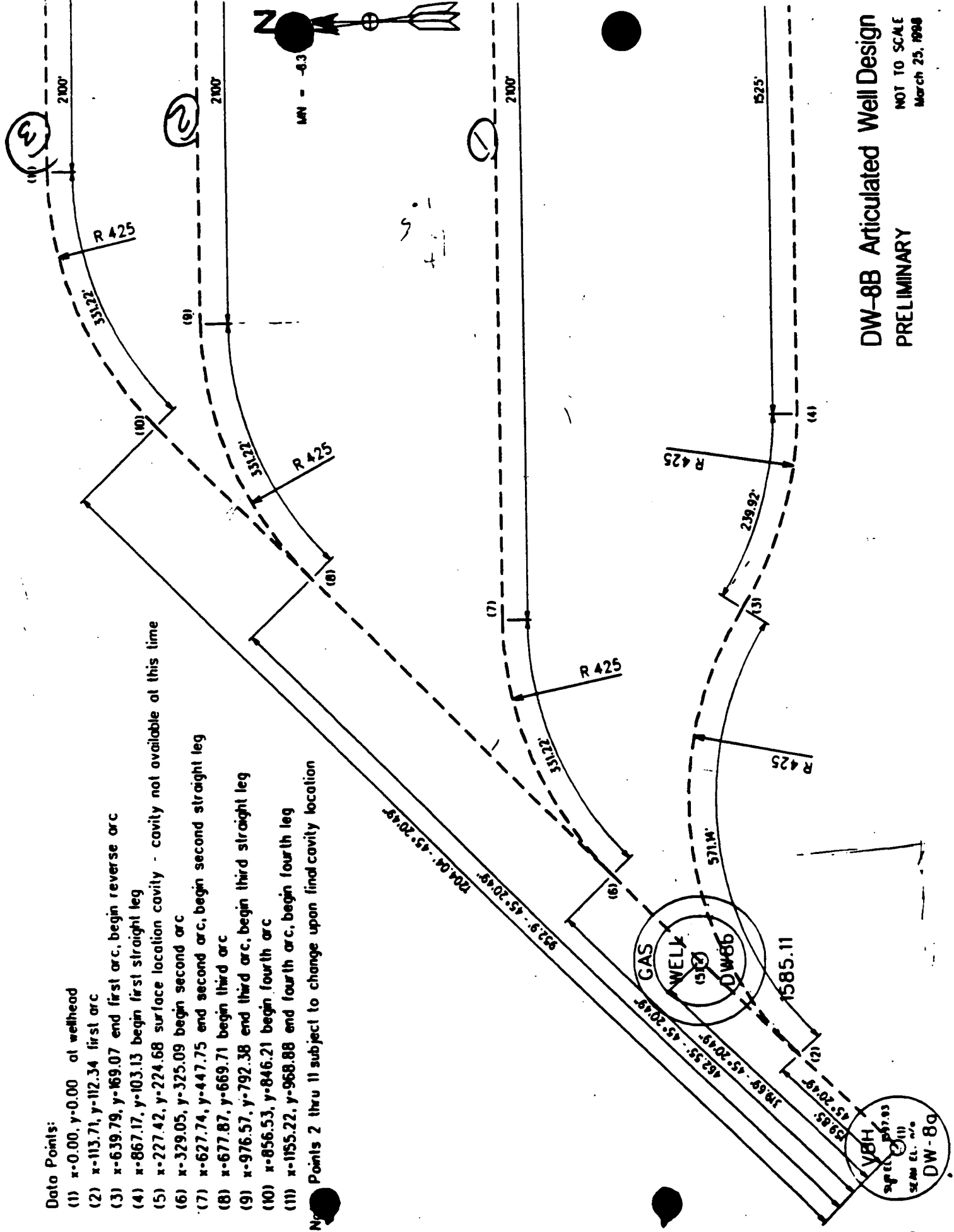
U S Steel Mining Company
Pineville, West Virginia
Wells DW-7 & DW-9

Ben L. Isgitt
Wilson Downhol
Engineer

Data Points:

- (1) x=0.00, y=0.00 at wellhead
- (2) x=113.71, y=112.34 first arc
- (3) x=639.79, y=169.07 end first arc, begin reverse arc
- (4) x=867.17, y=103.13 begin first straight leg
- (5) x=227.42, y=224.68 surface location cavity - cavity not available at this time
- (6) x=329.05, y=325.09 begin second arc
- (7) x=627.74, y=447.75 end second arc, begin second straight leg
- (8) x=677.87, y=669.71 begin third arc
- (9) x=976.57, y=792.38 end third arc, begin third straight leg
- (10) x=856.53, y=846.21 begin fourth arc
- (11) x=1155.22, y=968.88 end fourth arc, begin fourth leg

Points 2 thru 11 subject to change upon final cavity location



DW-8B Articulated Well Design
PRELIMINARY

NOT TO SCALE
March 25, 1998

CHECK LOG -
Formation Above
100'

FAY #

FAY #

- BIT ENCAIZ

 $3\frac{1}{2}$

- Torque/Drac Effect of 1.8° vs 1.5° Motor

HAVE HAY ON SITE

1 HAVE DRILLERS KEED GAMMA & PROFILE POSTED
2 & UPDATED

- ? SIDE TRACK - TOOL FACES (0 OR 180°?)

PIPE TALLY TO HIT CAVITY?

General Action Must Be Followed - Ex -

SIDE TRACK L = 1 to F (CAUTION)
 - From M. J. P. = 5. 1-5 (MAG) on
 V. L. 100 to F. 100 Error, Average
 RESULTS

ESSEITE
 Oxi-O-Tol
 NO. 753 1/5
 10%



1000 10-15 1000 10-15

* 1000 -
 *

Mary H. -
 F. 100 ?
 B. 100